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Apple Scab And Its Control

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In the apple growing regions throughout the country apple scab, which is caused by the fungus, *Venturia inaequalis*, is by far the most common and destructive fungous disease of the apple fruit and foliage. A study of the nature of the disease explains to a large extent why the trouble is so serious.

Distribution.—The apple scab fungus is present in all apple growing regions. It is generally, however, more serious in the northern apple growing district than in the southern. Many growers associate this disease with cool, damp weather.

Appearance on Leaves.—The spots are circular in shape, and usually from one-fourth to three-eighths of an inch in diameter. When there are several infections on the leaf, they may be even smaller than this. The infected areas may become raised with a corresponding depression on the lower surface. As the spots grow older the color changes from an olive brown to a grayish brown. Where sprays are applied after the fungus has secured entrance to the leaf, the spot is much more likely to take on a brown or blackish appearance. If the disease is serious the infected leaves may also be smaller than the normal healthy leaves and defoliation may occur.

Appearance on the Fruit.—The scab spots or lesions on the fruit resemble those on the upper surface of the apple leaves. The infected portions at first take on a clear appearance due to the fact that the cuticle remains as a thin skin over most of the diseased area. As the disease develops the cuticle breaks away from above the center area and exposes the characteristic olivaceous infected portion beneath. At this stage of development the lesion takes on a scabby appearance and is no doubt responsible for the origin of the name "apple scab."

Losses Heavy.—Apple scab may cause a large portion of the crop to go to the cull pile or to be classed as low grade. Moreover, the attack upon the leaves may be serious enough to cause partial defoliation, seriously hindering the growth of the trees.

Some of the best authorities dealing with the apple scab fungus have summarized the nature of the loss about as follows: First, a material reduction in the fruit crop by lessening the set of fruit; second, by impairing the efficiency and functioning process of the leaves; third, by reducing the size, quality, and appearance of the fruit; fourth, by lowering the keeping quality, or storage life of the fruit and making it susceptible to storage rots and maladies; and fifth, by increasing in number the windfalls prior to picking time.

Variety Susceptibility.—Like all fungous diseases, apple scab is more serious on some varieties than others, though all varieties of apples are subject to the disease and may be damaged materially. Certain varieties, however, are notorious for their susceptibility and these should be known by the growers, as it is necessary to spray such sorts more carefully than the more or less resistant varieties. Moreover, there are unaccountable variations or differences in the susceptibility of different varieties of apples in different parts of the country.

Under Missouri conditions, most growers would list the following apple varieties as very susceptible to apple scab: Rome Beauty, Winesap, Willow Twig, Ben Davis, Gano, Arkansas, Arkansas Black, Red June, Delicious, and Early Harvest.

The following varieties are relatively immune to apple scab: Jonathan, Golden Delicious, Grimes, King David, York Imperial, Ingram, Minkler, Wealthy, Ralls, Transparent, and Duchess.

Cause of Apple Scab.—Apple scab is caused by a fungus, *Venturia inaequalis*. In most cases the fungus passes the winter in infected leaves on the ground under the trees or near the orchard. During March and April the ascospores in the leaves are mature and are discharged to the air. These spores may be carried to the leaves and branches of the tree. Where moisture and temperature conditions are suitable, germination takes place in the foliage or fruit. It is important in this connection to know that ascospore discharge takes place during rainy periods and, under such conditions, when the spores are deposited upon the leaves or fruit, germination may take place readily.

With several rains occurring during a week, it is possible that as many disseminations of spores may take place. As a result, if conditions are favorable germination and infection on both fruit and foliage is likely to be increased accordingly.

Two Kinds of Spores Produced.—Apple scab is spread by two kinds of spores, known as winter spores and summer spores. It is necessary to base control measures upon this fact and the life history of the fungus. If infection takes place from the first discharge of winter spores, the developing leaves and fruit are exposed for some time to infection from two sources: first, winter spores from the old leaves, and second, summer spores from new diseased areas on the fruit and leaves.

It may be seen from this that successful control measures lie in preventing infection from the first discharge of winter spores. For this to be accomplished, it is necessary that the first spray be applied in advance of the first spore discharge. Following this, if protective sprays are applied at about two-week intervals, during the period winter spores are discharged, little difficulty will be experienced from later infections arising from summer spores.

Influence of Weather.—It must be understood that apple scab is a fungous disease and that it is not caused by rainy or cloudy weather conditions. It is true, however, that the weather is the most important environ-

mental factor influencing the spread and development of apple scab. Unless the disease is present, however, no injury can be done.

When rains fall just before the blossoms open, the discharge of ascospores may infect the young leaves and pedicles. In case the rains occur after the blossoms open, the discharge of spores occurs and infection develops not only upon the leaves and pedicles, but also upon the fruits.

Where for any reason the first infections do not occur within three or four weeks after the blossoms begin to open, it is likely that the attack of scab will be unimportant during the season. Moreover, when rather dry and rainless early spring seasons are experienced, less trouble from apple scab generally prevails. The best example of conditions very favorable for the development of apple scab were those that existed during the early spring and summer of 1929, when much rainfall occurred and when there was an unusual amount of cool damp cloudy weather.

CONTROL MEASURES

The destruction of the infected leaves on the ground during the late fall, winter season, or even early in the spring before the spores are discharged may help materially in the control of apple scab. Such destruction may be accomplished by cultivation, by raking and destroying the leaves, and in some cases by burning off the orchard. This latter suggestion is a dangerous one unless great caution is observed.

All the foregoing practices may be considered as supplementary to proper and timely spraying. Nearly all authorities agree that the grower should place his chief reliance in controlling scab, upon spraying.

Pre-Blossom Sprays Important.—The key to successful spraying against apple scab generally depends upon early, timely and thorough spraying before the trees bloom. The problem is to keep the new leaf and blossom tissues covered with the protective fungicide.

This is difficult as growth is proceeding rapidly. The leaves are extending and the buds are unfolding, which constantly exposes new tissues to infection. If suitable weather conditions develop, there is danger of injury from the time of the first appearance of the green leaves in the bud until after the blossoms drop and even much later in some seasons.

When scab development is at all serious, two pre-blossom sprays are usually needed for control. In some of the northern apple producing states where scab is often more serious, four pre-blossom sprays may be required for protection.

An application is always made when the cluster buds separate but before the blossoms open. If only two pre-blossom sprays are made, it is usually best to apply the first one at the delayed dormant or early pink stage, and the second, of course, at the time the cluster buds separate. When three pre-blossom sprays are used, one may be made in the delayed dormant, another at the pre-pink, and the third at the regular cluster bud period.

The very important fact which the grower should keep in mind is that the time and number of treatments should be adapted to the requirements of the individual orchard. Moreover, he must also appreciate and be fully aware of the great need of adequate protection through the highly critical pre-blossom period.

Spraying Practices Suggested.—Where the disease is likely to be serious and where susceptible varieties of apples are being grown, the grower will use

good judgment by making two fungicidal sprays before the blooming period. The first may be applied at what is generally designated as the pre-pink stage, or when the buds have made sufficient growth and development as to allow the green leaves to appear. The next stage of advancement for the second application is at the so-called pink stage, or cluster bud period, while the third period for effective results in spraying is at the calyx period, or immediately following the falling or dropping of the petals.

The above three periods are generally considered the critical or important times for spray applications, although it is necessary most years to continue to apply cover sprays at no greater intervals than 10 to 14 days. Moreover, in seasons like that of 1929, these applications should be continued for scab control up until July first.

Since it is important in the Central States particularly that we control other diseases, especially apple blotch, as well as apple scab and also attacks of codling moth, curculio, and other insects, it is important that the fungicidal and insecticidal sprays be continued from the calyx period up until within about 5 to 6 weeks of harvest time, making in all from 6 to 7 to as many as 8 or 9 spring and summer spray applications. The exact number of sprays will depend, of course, upon the severity of the attack to be controlled and the length of the growing season.

Kinds of Spray to Use.—The spraying chemicals to use may consist of either lime-sulphur or bordeaux. Lime-sulphur at a strength of from 2 to 2½ gallons to 100 gallons of water plus 2 pounds of arsenate of lead is preferred, particularly for the early applications, as it is less likely to do injury by russeting or burning the young fruits than bordeaux and arsenate of lead.

Moreover, the first cover spray following the calyx period, if made within 10 or 12 days, should consist of lime-sulphur and arsenate of lead, on account of the danger of russeting or burning the young fruits at this time. Where apple blotch is serious, all later sprays should consist of bordeaux 4-6-100 and 2 pounds of arsenate of lead, because bordeaux gives better control of apple blotch than lime-sulphur and arsenate of lead.